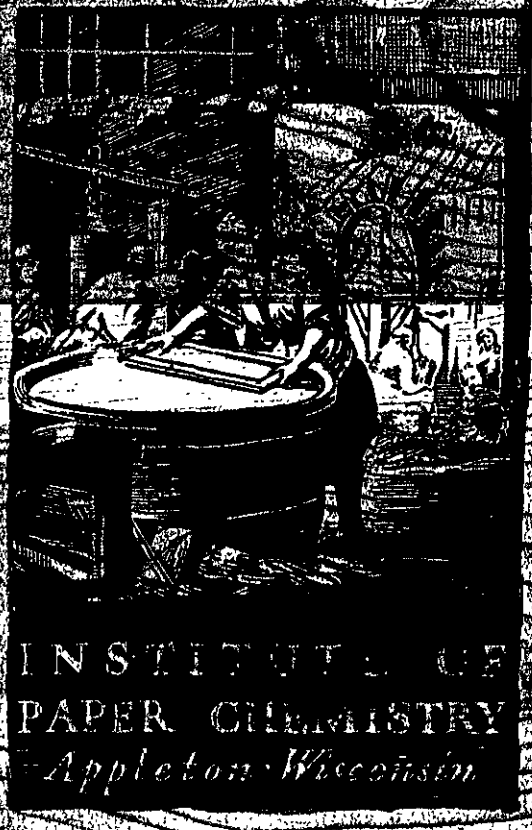

CONTINUOUS BASELINE STUDY

Project 1108-B

Summary Report

to

FOURDRINIER KRAFT BOARD INSTITUTE, INC.

October 1, 1953

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

Continuous Baseline Study

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This report is a summary of the results obtained in conjunction with the Continuous Baseline Study from September 1, 1950 to July 31, 1951--a period of eleven months--and is supplementary to a similar report dated October, 1950. The duration of each reported period as well as the number of samples submitted is given in Table I, and the number of samples submitted by each mill for each of the reported periods is shown in Table II. Also shown in Table II is the total number of samples submitted by each mill for the eleven periods.

As mentioned above, the summary report dated October, 1950, presented data for the first 38 periods of the Continuous Baseline Study. It may be of interest to note how the trends for the 39th to 49th periods (September 1, 1950 to July 31, 1951) fit in with those for the first 38 periods (June 25, 1947, to August 31, 1950). First, consider the current F.K.I. averages for basis weight. During the first 38 periods, the average basis weight values were predominantly above the 43-lb. level. However, for the interim from the 39th to 49th periods, basis weight values have always been below the 43-lb. level, averaging 42.7 lb. with a minimum of 42.4 lb.

The current F.K.I. caliper averages exhibited a definite trend downward, from 16.6 to 13.4 points, during the first 38 periods. From period 39 to period 49, caliper values have maintained a very low level, the lowest value being 13.2 points for the 46th period. In general, caliper values have continued to decrease.

TABLE I

DURATION OF REPORTED PERIODS--NUMBER OF 42-LB. KRAFT LINERBOARD SAMPLES PER PERIOD

Reported Period	Duration	Number of Samples
39	September 1 through September 30, 1950	81
40	October 1 through October 31, 1950	83
41	November 1 through November 30, 1950	91
42	December 1 through December 31, 1950	77
43	January 1 through January 31, 1951	81
44	February 1 through February 28, 1951	88
45	March 1 through March 31, 1951	73
46	April 1 through April 30, 1951	85
47	May 1 through May 31, 1951	79
48	June 1 through June 30, 1951	91
49	July 1 through July 31, 1951	84

TABLE II

TABULATION BY PERIODS OF THE NUMBER OF SAMPLES OF 42-LB. KRAFT LINERBOARD SUBMITTED BY EACH MILL

	Mills											
Period	A	B	C	D	F	G	H	I	J	K	L	M
39	9	13	7	18	9	8	6	7	4	--	--	--
40	7	15	7	22	5	8	6	3	10	--	--	--
41	11	20	7	15	9	8	10	7	4	--	--	-
42	7	16	1	17	13	6	4	3	7	--	3	--
43	10	20	5	12	12	4	7	2	6	--	3	--
44	6	20	6	13	7	10	7	8	6	--	5	--
45	10	16	0	13	6	6	4	7	6	--	5	--
46	10	12	9	14	9	8	8	5	6	--	4	--
47	8	16	8	12	9	6	4	7	4	--	3	2
48	8	20	8	12	6	6	8	6	5	--	4	8
49	8	12	4	12	9	8	8	5	6	1	1	10
Total	94	180	62	160	94	78	72	60	64	1	28	20

The first 38 periods of the Continuous Baseline Study witnessed a substantial rise in bursting strength results, the highest current F.K.I. average reached being 113 p.s.i.g. for the 22nd period. After the 22nd period, the bursting strength values started to decline gradually. This gradual decline has continued to the present time as indicated by the current F.K.I. average for period 49 of 104 p.s.i.g.

The G. E. puncture values were at their highest level in the first nine periods of the Continuous Baseline Study. Since then, they have gradually declined and leveled off, beginning with period 37 and continuing to the present, at a value of 35 units.

The current F.K.I. Elmendorf tear averages have gradually declined with each new period. This gradual declination has continued for the interim from periods 39 to 49.

Thus, the over-all trends for the first 49 periods of the Continuous Baseline Study are these:

1. Basis weight maintained a relatively constant level for the first 38 periods but since then has decreased somewhat.
2. Caliper values have decreased.
3. Bursting strength reached a maximum level at the 22nd period (April 1 to 30, 1949) and held that level to the 36th period (June 1 to 30, 1950) when it started a downward trend.
4. G. E. puncture declined to the 38th period (August 1 to 30, 1951) and leveled off.
5. Elmendorf tear has exhibited a gradual decline.

The current F.K.I. averages for the 39th to 49th periods are presented in Table III and are shown graphically in Figure 1. It may be noted from Figure 1 that the basis weight results have remained relatively constant. It is evident that the caliper values have decreased; the bursting strength and G. E. puncture values have remained relatively constant; and the tearing strength values appear to have decreased somewhat. In summation, the trends during the eleven-month period from September 1, 1950 to July 31, 1951 are these:

1. Basis weight results relatively constant at about a 42.7-lb. level.
2. Lower caliper results, currently at a 13.3-pt. level.
3. Constant bursting strength results, currently at about a 104-p.s.i.g. level.
4. Constant G. E. puncture results, currently at about a 35-unit level.
5. Slightly lower tearing strength results, currently at about 370 and 400-g./sheet levels for in and cross-machine directions, respectively.

The current mill averages for Mill A are presented in Table IV and represented graphically in Figure 2. The following trends are evident for Mill A: higher basis weight, lower caliper, higher bursting strength, slightly higher G. E. puncture, and relatively constant tearing strength results.

A presentation of the current mill averages for Mill B is given in Table V. A graphical presentation is shown in Figure 3. No

TABLE III

TABULATION OF CURRENT F.K.I. AVERAGES BY PERIODS

Period	Basis Weight, lb.	Caliper, points	Bursting Strength, p.s.i.g.	G.E. Puncture, units	Elmendorf Tear, g./sheet	
					In	Across
39	42.9	13.6	105	35	369	402
40	42.9	13.8	104	36	379	412
41	42.9	13.4	102	34	371	403
42	42.9	13.3	102	35	374	408
43	42.6	13.4	102	36	373	401
44	42.5	13.4	104	35	357	390
45	42.7	13.3	105	35	362	395
46	42.4	13.2	105	35	359	393
47	42.6	13.4	104	35	365	399
48	42.6	13.3	103	36	367	397
49	42.8	13.3	104	35	362	397

TABLE IV

TABULATION OF CURRENT AVERAGES BY PERIODS FOR MILL A

Period	Basis Weight, lb.	Caliper, points	Bursting Strength, p.s.i.g.	G.E. Puncture, units	Elmendorf Tear, g./sheet	
					In	Across
39	42.6	12.9	103	33	347	382
40	42.4	13.4	102	33	361	392
41	42.6	13.1	102	31	323	374
42	42.4	12.9	100	30	338	371
43	42.1	13.1	101	33	361	384
44	42.0	12.7	108	34	343	378
45	43.0	12.8	112	34	353	395
46	42.7	12.3	111	34	350	393
47	42.9	12.8	108	34	343	397
48	43.1	12.3	107	35	363	399
49	42.9	12.7	112	34	367	401

FIGURE 1

COMPARISON OF CURRENT F.K.I. AVERAGES BY PERIODS

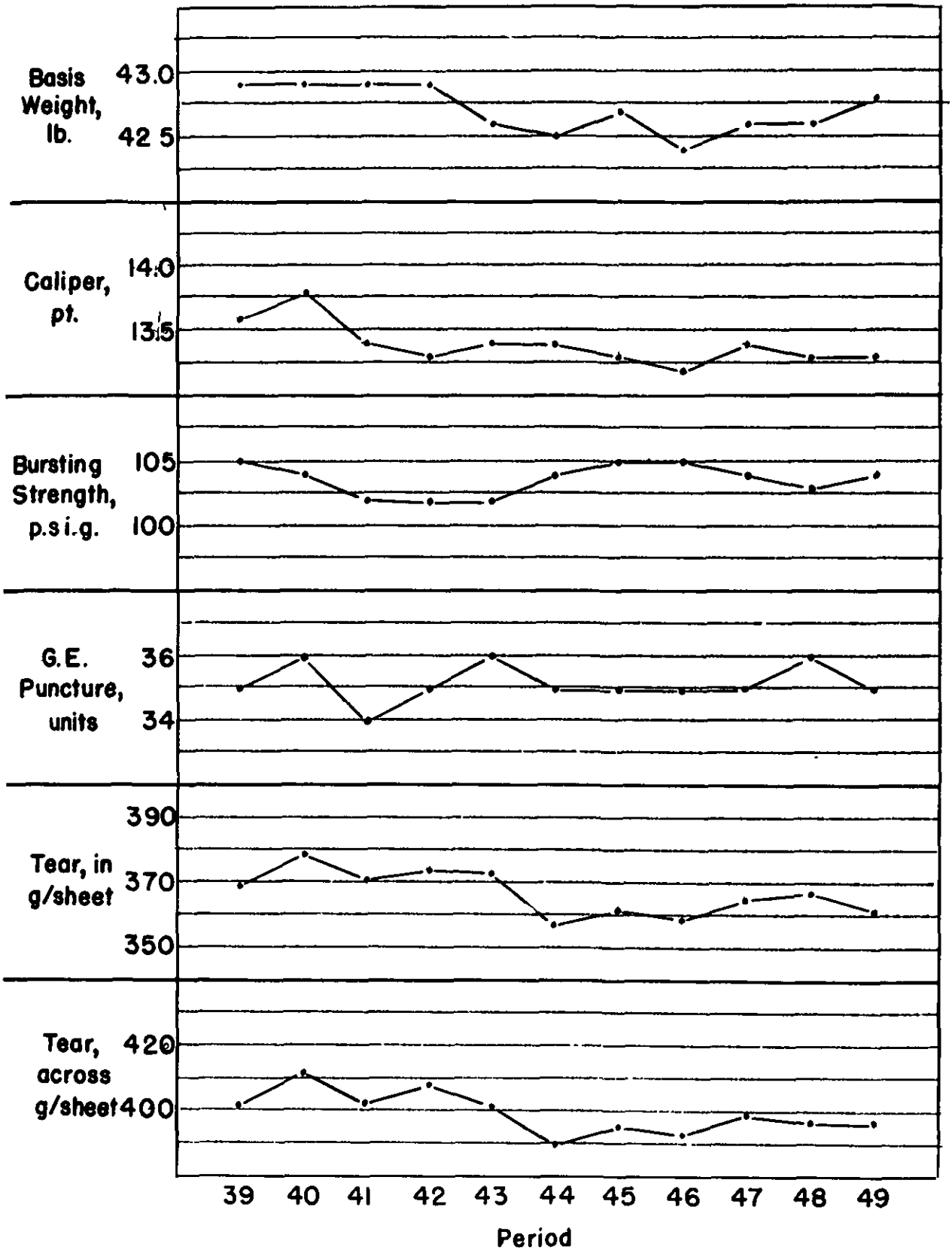


FIGURE 2

COMPARISON OF CURRENT AVERAGES BY PERIODS FOR MILL A

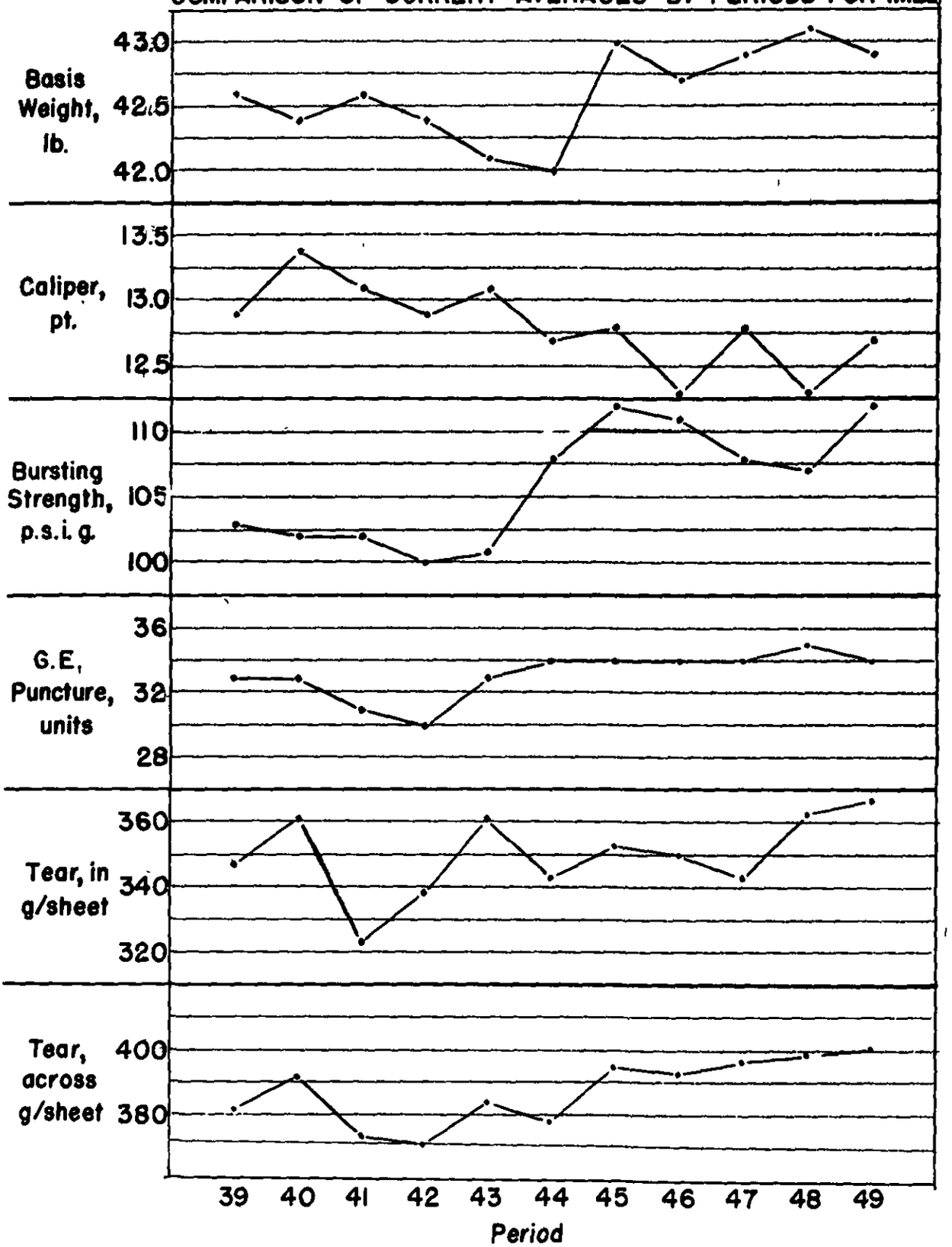
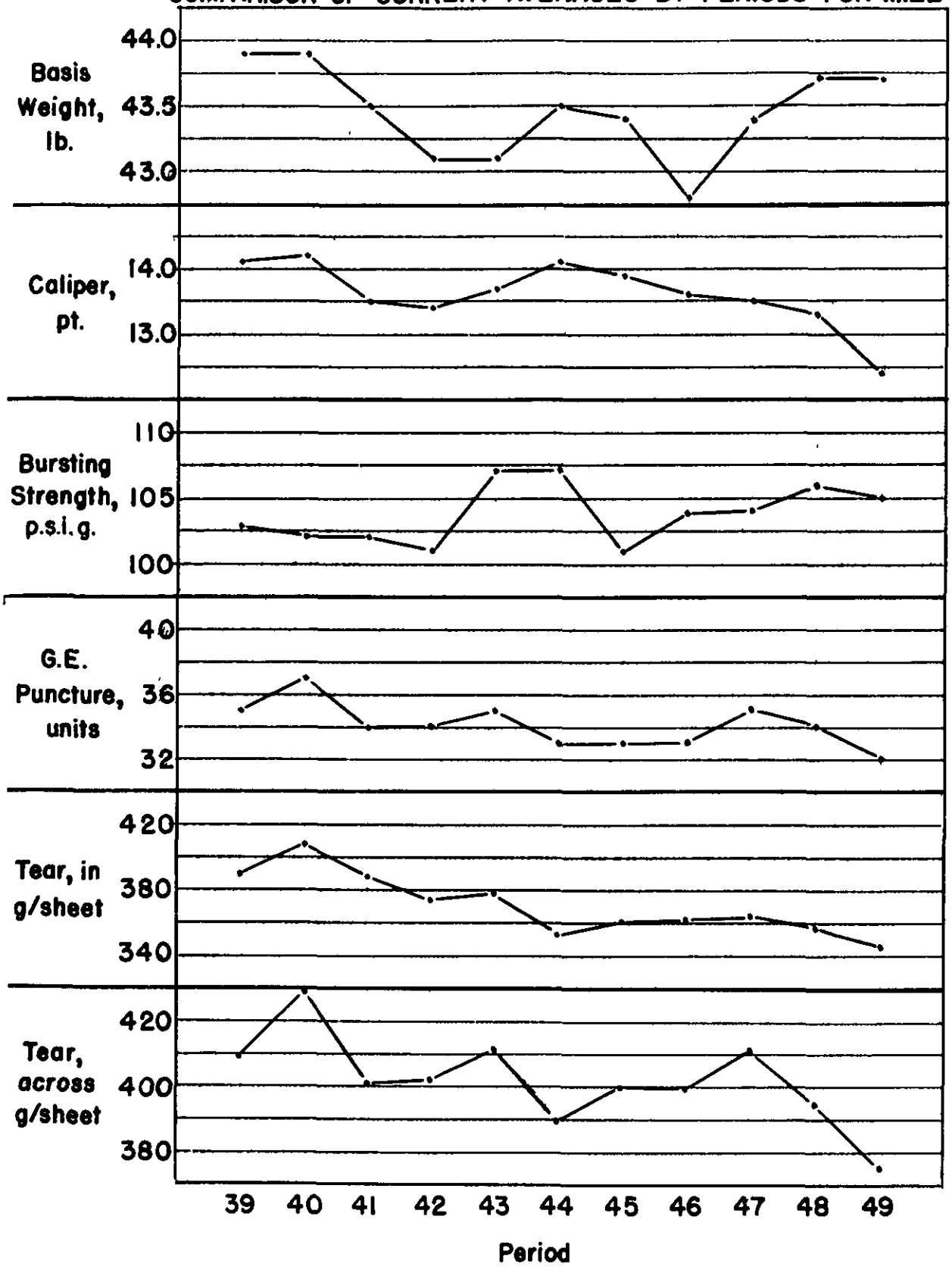


FIGURE 3

COMPARISON OF CURRENT AVERAGES BY PERIODS FOR MILL B



definite trend appears to be present in the basis weight results. However, the caliper values have decreased whereas the bursting strength values have increased. The G. E. puncture and tearing strength values have also decreased.

Presented in Table VI are the current mill averages for Mill C. These averages are presented graphically in Figure 4. The following observations have been made from the data: (1) Basis weight has decreased; (2) caliper has decreased; (3) bursting strength has remained relatively constant; (4) G.E. puncture has decreased slightly; and (5) tearing strength has decreased somewhat.

The current mill averages for Mill D are shown in Table VII and are presented graphically in Figure 5. The following trends are evident from the data: lower basis weight, lower caliper, higher bursting strength, slightly lower G. E. puncture, and lower tearing strength values. Every test with the exception of bursting strength has decreased somewhat.

Figure 6 presents graphically the current mill averages shown in Table VIII for Mill F. The following conclusions have been made: The basis weight values have remained relatively constant; caliper values decreased during the interim from periods 41 to 46 and since then have been on the upgrade. Bursting strength results have been declining to the 49th period when they increased substantially. G. E. puncture values have maintained a high level while tear values declined to the 49th period when a substantial rise was observed.

TABLE V

TABULATION OF CURRENT AVERAGES BY PERIODS FOR MILL B

Period	Basis Weight, lb.	Caliper, points	Bursting Strength, p.s.i.g.	G. E. Puncture, units	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across
39	43.9	14.1	103	35	390	409
40	43.9	14.2	102	37	408	429
41	43.5	13.5	102	34	389	401
42	43.1	13.4	101	34	374	402
43	43.1	13.7	107	35	378	411
44	43.5	14.1	107	33	353	389
45	43.4	13.9	101	33	361	400
46	42.8	13.6	104	33	362	399
47	43.4	13.5	104	35	365	411
48	43.7	13.3	106	34	357	394
49	43.7	12.4	105	32	346	375

TABLE VI

TABULATION OF CURRENT AVERAGES BY PERIODS FOR MILL C

Period	Basis Weight, lb.	Caliper, points	Bursting Strength, p.s.i.g.	G. E. Puncture, units	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across
39	42.8	13.9	105	37	378	416
40	42.6	14.0	101	38	394	435
41	42.8	14.0	100	38	385	425
42	42.9	13.5	104	40	415	465
43	43.7	14.1	102	42	407	443
44	42.5	13.6	105	38	372	407
45	--	--	--	--	--	--
46	42.3	14.0	104	39	375	413
47	41.8	13.3	103	37	372	417
48	42.1	13.3	104	38	364	411
49	42.1	13.4	105	35	344	388

TABLE VII

TABULATION OF CURRENT AVERAGES BY PERIODS FOR MILL D

Period	Basis Weight, lb.	Caliper, points	Bursting Strength, p.s.i.g.	G. E. Puncture, units	Elmendorf Tear, g./sheet	
					In	Across
39	43.3	13.9	107	39	415	435
40	43.2	13.6	104	38	417	435
41	43.4	13.3	100	39	418	431
42	43.9	13.2	102	40	422	432
43	42.8	13.0	106	39	400	420
44	42.5	12.9	109	37	386	407
45	42.8	12.7	113	37	395	416
46	42.8	13.3	110	37	393	421
47	42.8	12.8	108	36	394	412
48	42.8	12.9	108	38	400	411
49	42.8	13.1	113	38	391	423

TABLE VIII

TABULATION OF CURRENT AVERAGES BY PERIODS FOR MILL F

Period	Basis Weight, lb.	Caliper, points	Bursting Strength, p.s.i.g.	G. E. Puncture, units	Elmendorf Tear, g./sheet	
					In	Across
39	42.0	13.8	107	36	389	425
40	42.3	14.0	110	38	385	427
41	41.8	13.0	108	35	382	416
42	41.8	12.9	100	38	386	424
43	41.6	13.1	103	40	388	431
44	42.0	13.0	99	40	376	417
45	41.7	12.6	103	39	372	415
46	41.7	13.1	97	40	373	417
47	42.0	13.6	97	39	373	414
48	42.2	14.0	97	40	386	418
49	43.2	14.0	109	41	397	437

FIGURE 4

COMPARISON OF CURRENT AVERAGES BY PERIODS FOR MILL C

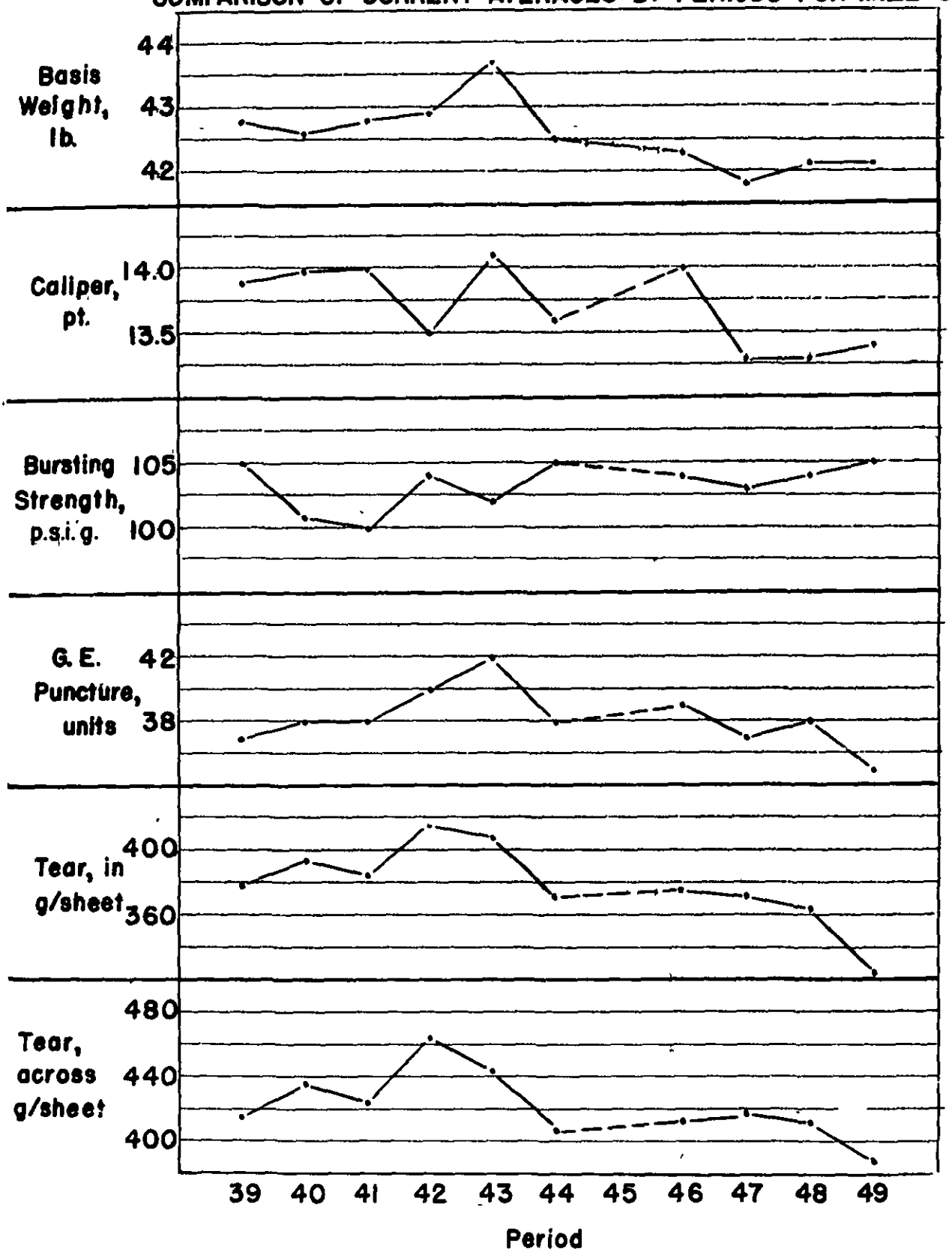


FIGURE 5

COMPARISON OF CURRENT AVERAGES BY PERIODS FOR MILL D

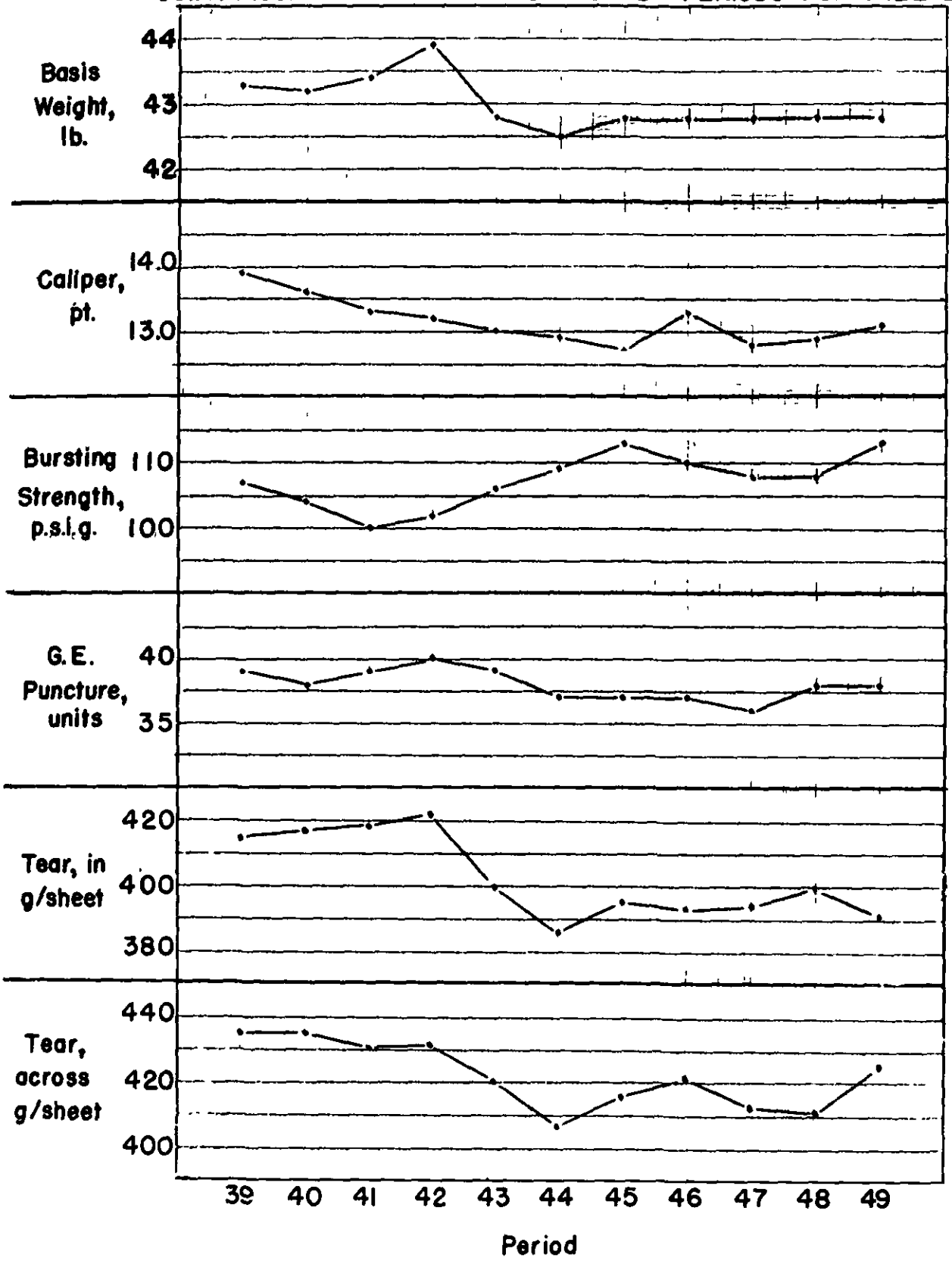
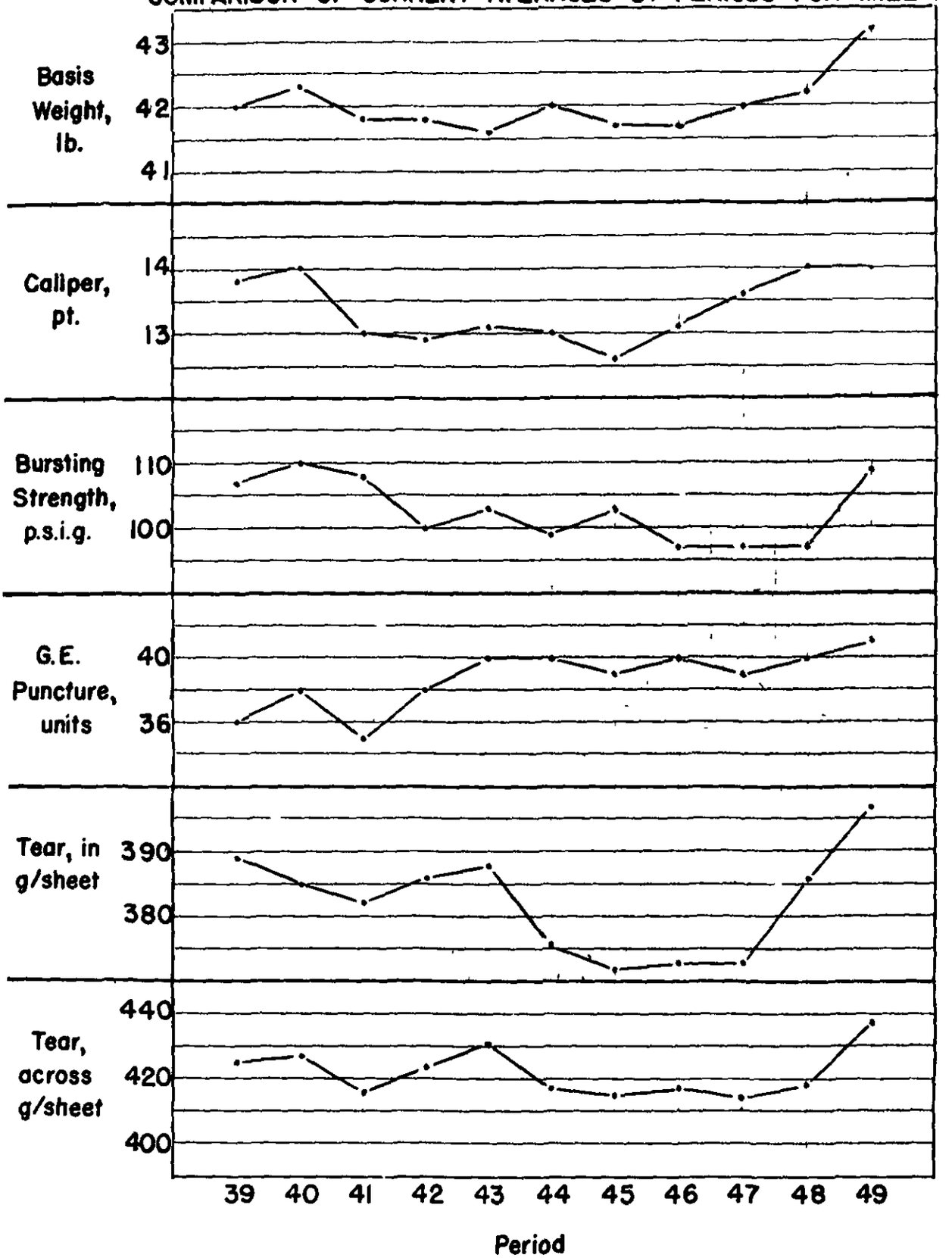


FIGURE 6

COMPARISON OF CURRENT AVERAGES BY PERIODS FOR MILL F



Shown in Table IX and Figure 7 are the current mill averages for Mill G. No specific trends are indicated in Figure 7.

In Table X and Figure 8, the current mill averages for Mill H are presented. The graphic presentation in Figure 8 reveals that the basis weight results have remained relatively constant; the caliper results have, in general, decreased slightly; the bursting strength results seem to have decreased substantially, whereas the puncture results have not changed materially; and the tear results appear to be increasing after a substantial drop during the 43rd and 44th periods.

The current mill average results for Mill I, shown graphically in Figure 9, are presented in Table XI. Several trends are evident from the plotted data. All the tests with the exception of bursting strength appear to have decreased. The bursting strength results, however, have increased somewhat.

A graphical presentation of the current mill averages for Mill J is given in Figure 10. The results are also shown in Table XII. From the plots shown in Figure 10, it appears that the basis weight, caliper, and puncture values have remained quite constant while the bursting strength and tear values have decreased.

Inasmuch as data are available for Mill K for only one period, no conclusions as to trends are possible. The results are shown in Table XIII.

The current mill averages for Mill L are given in Table XIV and presented in graphic form in Figure 11. It may be noted in Figure 11

TABLE IX

TABULATION OF CURRENT AVERAGES BY PERIODS FOR MILL G

Period	Basis Weight, lb.	Caliper, points	Bursting Strength, p.s.i.g.	G. E. Puncture, units	Elmendorf Tear, g./sheet	
					In	Across
39	43.1	13.3	105	35	348	384
40	43.1	14.0	103	35	351	383
41	43.2	13.3	103	33	327	369
42	42.7	12.5	106	32	334	377
43	42.5	13.7	95	34	347	361
44	42.4	13.5	102	34	322	358
45	42.7	13.6	101	35	342	366
46	42.4	13.3	104	33	334	357
47	43.0	13.4	109	35	344	370
48	42.9	13.8	103	37	364	390
49	42.5	14.0	104	34	336	361

TABLE X

TABULATION OF CURRENT AVERAGES BY PERIODS FOR MILL H

Period	Basis Weight, lb.	Caliper, points	Bursting Strength, p.s.i.g.	G. E. Puncture, units	Elmendorf Tear, g./sheet	
					In	Across
39	42.7	13.6	105	34	355	403
40	42.7	12.9	106	35	364	417
41	42.6	13.4	102	34	382	412
42	42.6	13.4	104	34	384	420
43	43.2	12.6	103	32	346	395
44	42.2	13.1	103	33	350	380
45	42.7	13.4	104	34	360	393
46	42.6	13.1	105	34	363	384
47	42.5	12.8	104	34	372	390
48	42.8	13.1	99	34	377	398
49	42.6	13.0	101	34	365	396

TABLE XI

TABULATION OF CURRENT AVERAGES BY PERIODS FOR MILL I

Period	Basis Weight, lb.	Caliper, points	Bursting Strength, p.s.i.g.	G. E. Puncture, units	Elmendorf Tear, g./sheet	
					In	Across
39	43.2	14.0	101	34	351	404
40	42.8	14.3	101	34	361	409
41	43.3	13.8	101	33	354	408
42	43.2	14.1	99	34	350	408
43	41.3	13.9	100	35	390	395
44	43.1	13.7	108	34	349	405
45	42.6	13.9	102	32	339	405
46	42.2	13.1	111	32	335	396
47	42.1	13.3	108	32	340	393
48	42.0	13.5	99	32	317	376
49	42.9	13.3	104	32	326	376

TABLE XII

TABULATION OF CURRENT AVERAGES BY PERIODS FOR MILL J

Period	Basis Weight, lb.	Caliper, points	Bursting Strength, p.s.i. g.	G. E. Puncture, units	Elmendorf Tear, g./sheet	
					In	Across
39	42.8	13.4	105	32	351	361
40	43.1	13.6	105	33	368	384
41	42.7	13.4	104	34	379	391
42	42.5	13.3	101	33	372	391
43	42.5	13.5	99	33	353	371
44	42.6	13.6	100	33	369	377
45	42.9	13.6	103	34	367	380
46	42.2	13.4	102	32	337	361
47	42.3	13.5	98	33	361	373
48	42.8	13.7	98	33	358	368
49	42.8	13.4	99	33	361	370

TABLE XIII

TABULATION OF CURRENT AVERAGES BY PERIODS FOR MILL K

Period	Basis Weight, lb.	Caliper, points	Bursting Strength, p.s.i.g.	G. E. Puncture, units	Elmendorf Tear, g./sheet In	Across
49	42.2	12.5	95	36	347	400

TABLE XIV

TABULATION OF CURRENT AVERAGES BY PERIODS FOR MILL L

Period	Basis Weight, lb.	Caliper, points	Bursting Strength, p.s.i.g.	G. E. Puncture, units	Elmendorf Tear, g./sheet In	Across
42	43.8	14.1	105	37	361	393
43	43.4	13.4	109	36	360	399
44	42.6	13.6	102	36	349	385
45	42.6	13.3	104	35	367	387
46	42.4	12.9	108	36	366	388
47	42.7	13.8	103	35	363	385
48	42.3	13.4	106	36	356	389
49	42.6	13.7	98	35	365	411

FIGURE 7

COMPARISON OF CURRENT AVERAGES BY PERIODS FOR MILL G

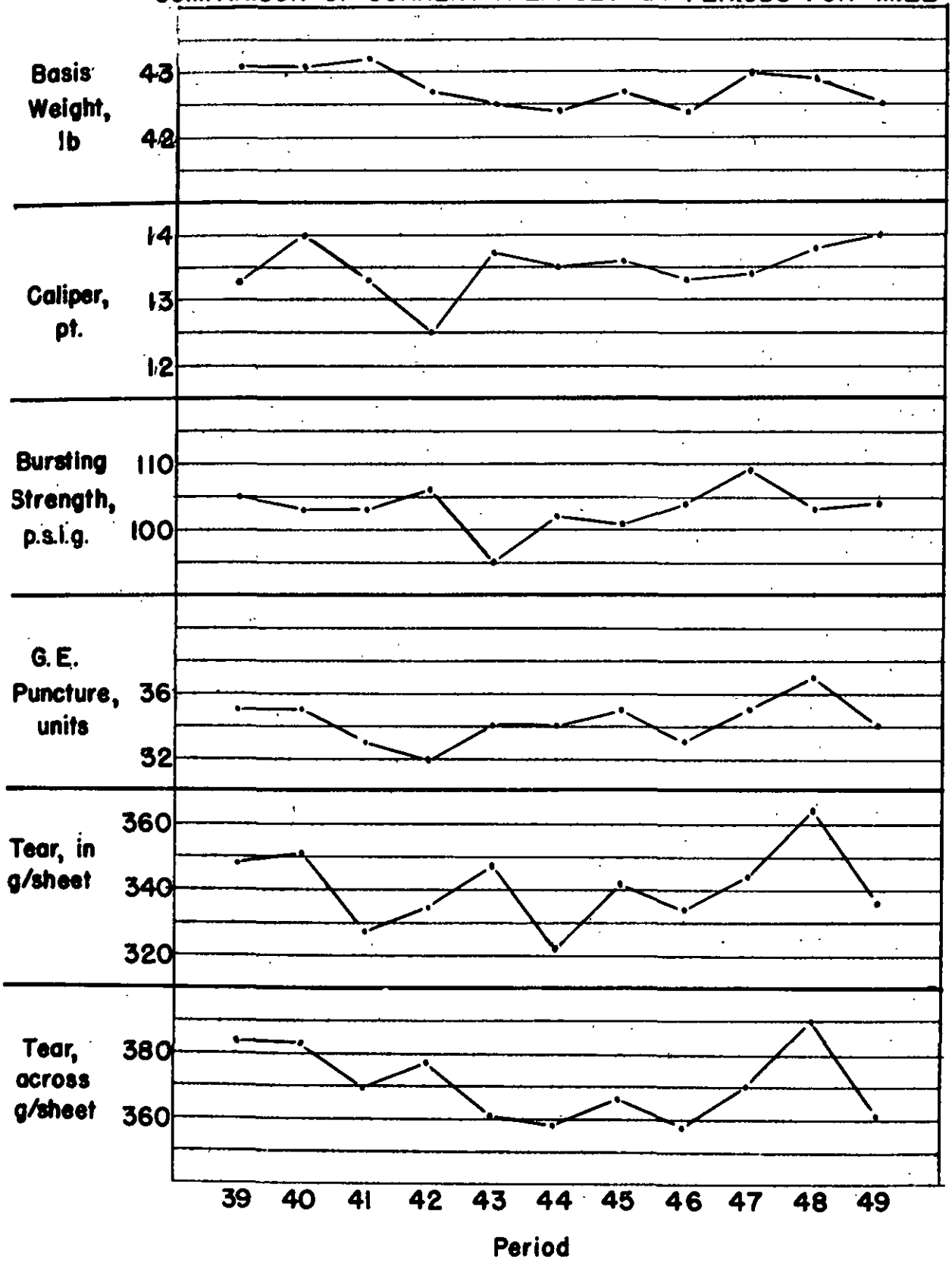


FIGURE 8

COMPARISON OF CURRENT AVERAGES BY PERIODS FOR MILL H

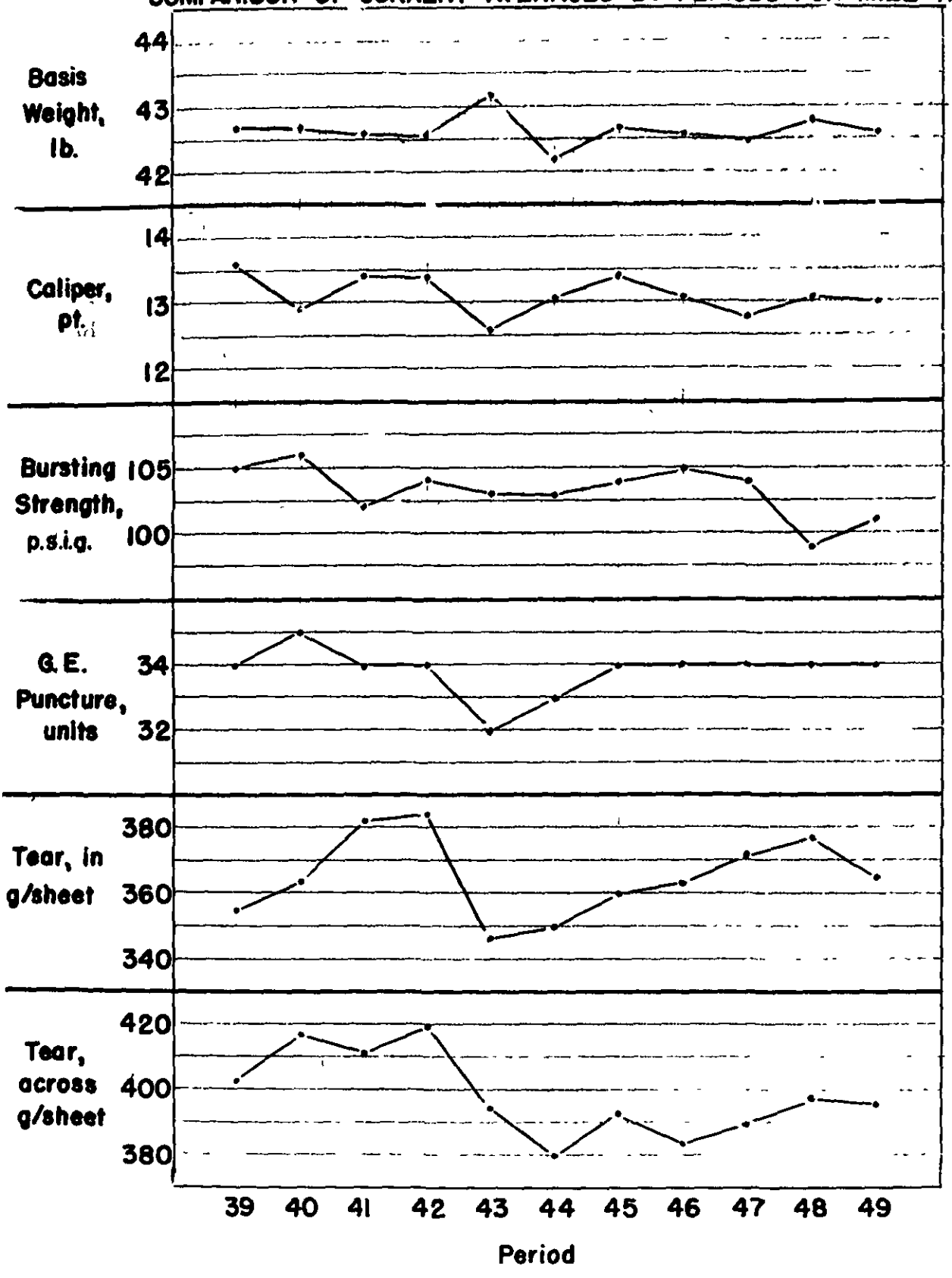


FIGURE 9

COMPARISON OF CURRENT AVERAGES BY PERIODS FOR MILL I

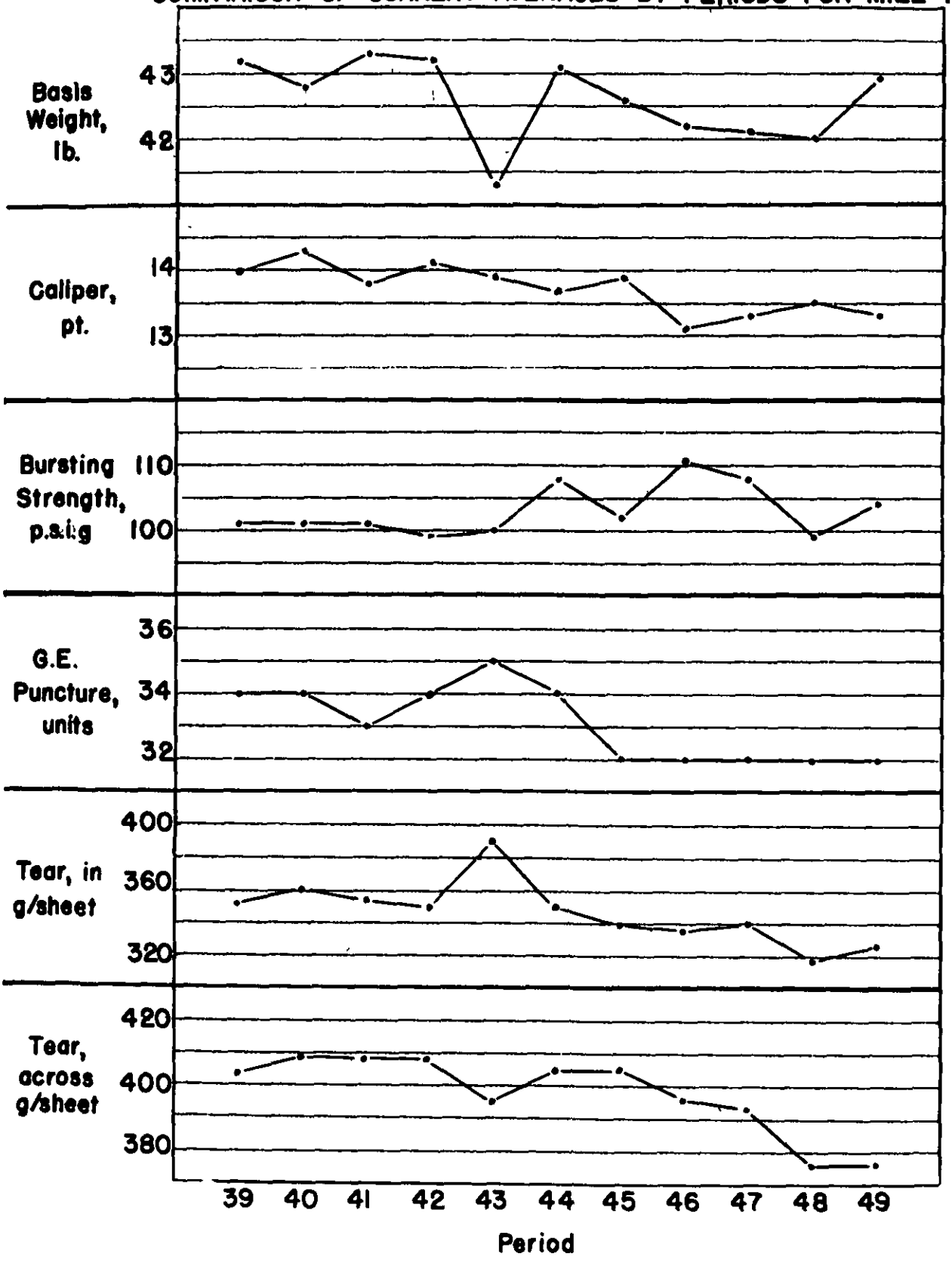


FIGURE 10

COMPARISON OF CURRENT AVERAGES BY PERIODS FOR MILL J

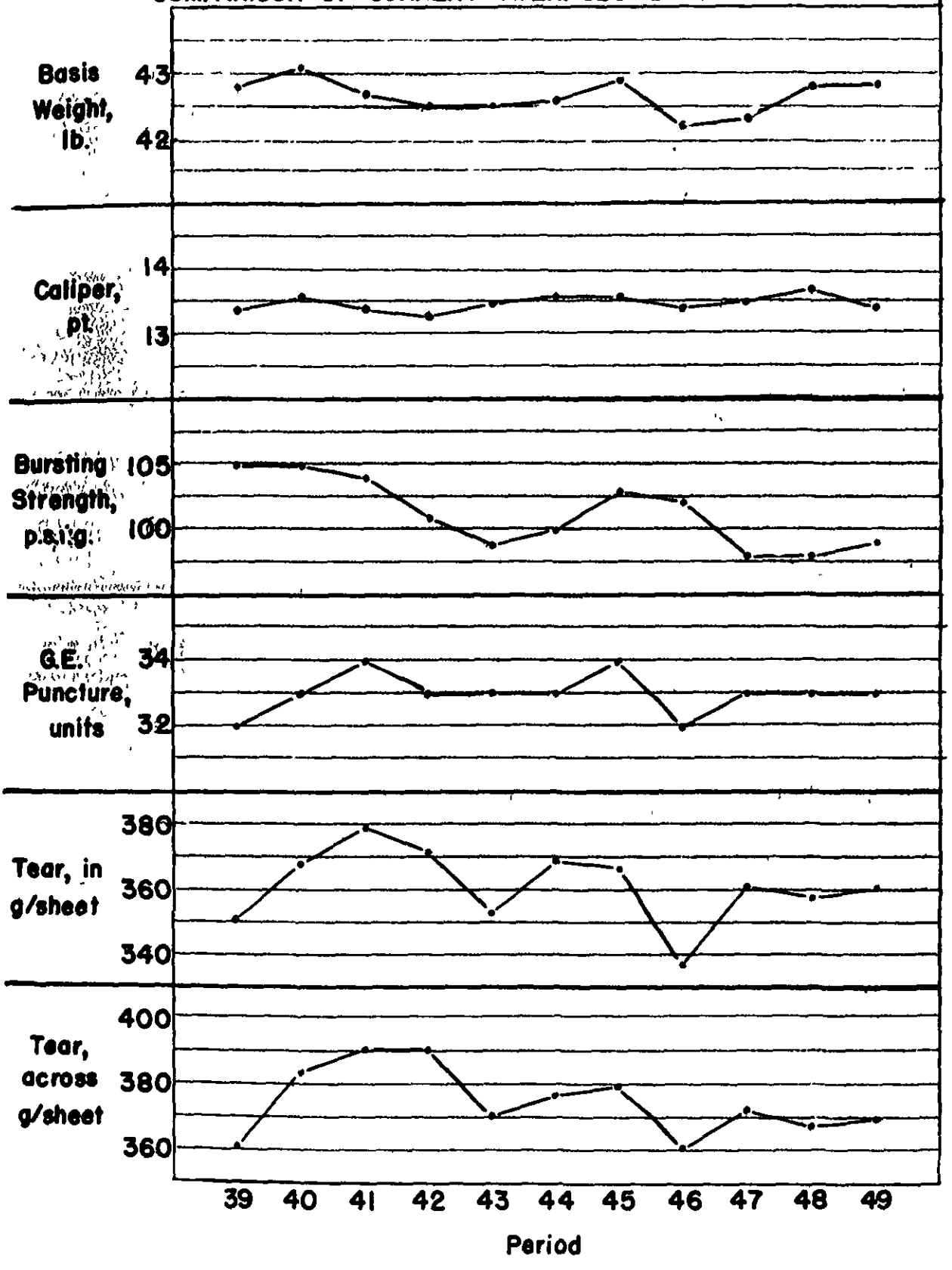
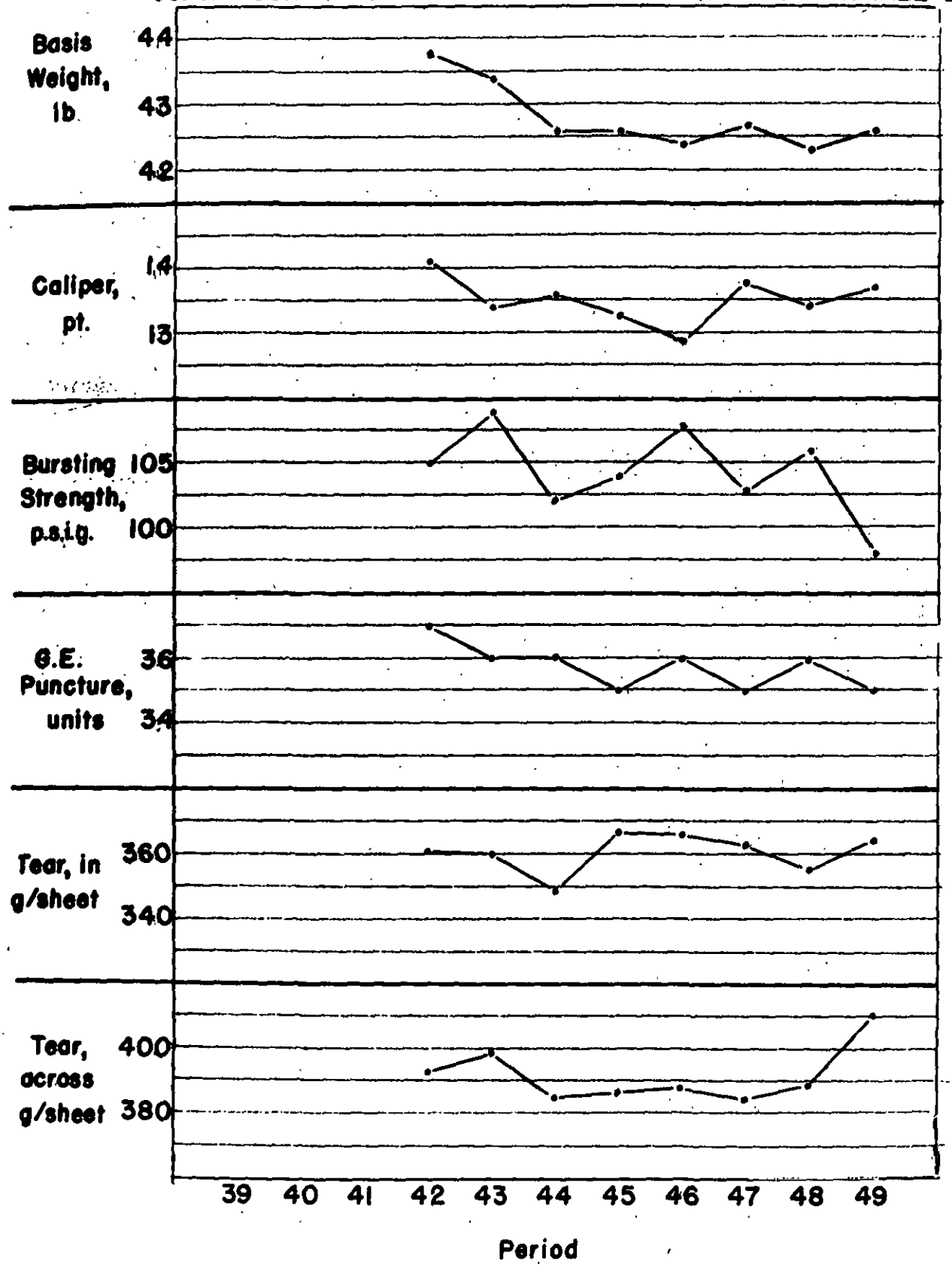


FIGURE 11.

COMPARISON OF CURRENT AVERAGES BY PERIODS FOR MILL L



that the basis weight results have decreased and leveled off; the caliper results have not maintained any given level or exhibited any definite trends; the bursting strength results have varied substantially from period to period; the puncture results have decreased slightly, and the tear results have maintained a fairly constant level.

Mill M has participated in the Continuous Baseline Study beginning with period 47. The current mill averages are shown in Table XV and a graphic presentation is given in Figure 12. No significant conclusions seem possible because of the limited data.

Table XVI presents the drum linerboard results for Mill E for the period 39 to 50. These results are presented graphically in Figure 13. The following trends are evident from the plotted data; lower basis weight, lower caliper, higher bursting strength, lower puncture and lower tear results.

The trends for most of the mills briefly summarized are these: lower weight and caliper, relatively constant bursting strength and puncture, and somewhat lower tearing strength.

TABLE XV

TABULATION OF CURRENT AVERAGES BY PERIODS FOR MILL M

Period	Basis Weight, lb.	Caliper, points	Bursting Strength, p.s.i.g.	G. E. Puncture, units	Elmendorf Tear, g./sheet In	Across
47	42.9	14.3	107	39	387	431
48	42.3	13.4	101	37	393	411
49	43.0	14.1	104	38	397	423

TABLE XVI

TABULATION OF CURRENT AVERAGES BY PERIODS FOR MILL E
(Drum Linerboard)

Period	Basis Weight, lb.	Caliper, points	Bursting Strength, p.s.i.g.	G. E. Puncture, units	Elmendorf Tear, g./sheet In	Across
39	48.5	15.2	91	41	462	417
40	48.2	14.6	93	41	448	428
41	49.2	15.8	85	42	474	432
42	48.5	15.3	94	43	470	438
43	48.3	15.4	92	43	454	430
44	47.5	15.2	90	42	448	403
45	48.3	14.9	99	42	461	416
46	48.8	15.0	104	41	457	422
47	48.2	14.4	101	41	467	416
48	47.7	14.5	104	39	465	406
49	46.0	13.7	105	35	434	383

FIGURE 12

COMPARISON OF CURRENT AVERAGES BY PERIODS FOR MILL M

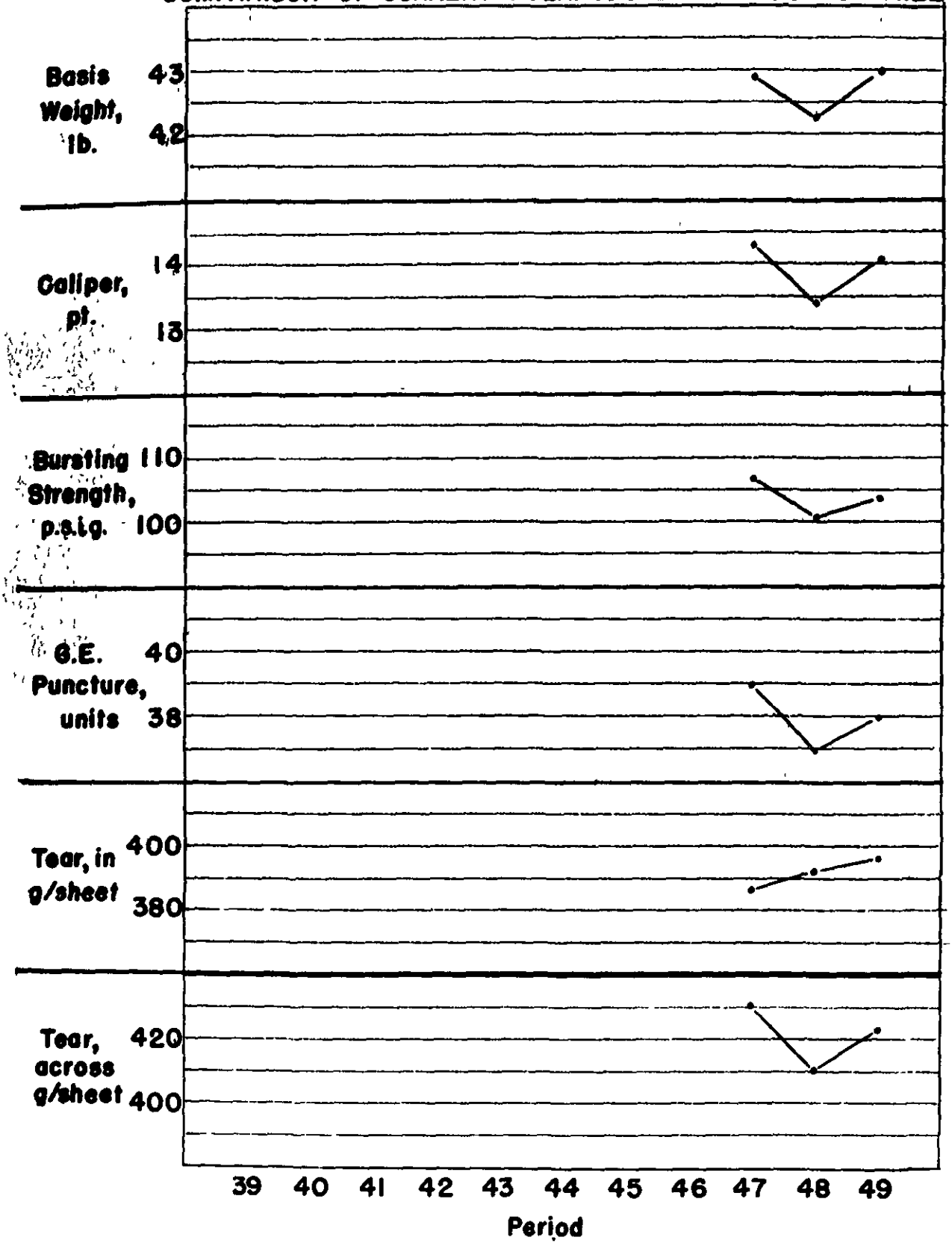


FIGURE 13

COMPARISON OF CURRENT AVERAGES BY PERIODS FOR MILL E

(Drum Linerboard)